

NON-PUBLIC?: N
ACCESSION #: 8808030357
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Nine Mile Point Unit 2 PAGE: 1 of 6

DOCKET NUMBER: 05000410

TITLE: Reactor Scram due to Degraded Feedwater Flow/Manufacturing Deficiency
EVENT DATE: 06/22/88 LER #: 88-025-00 REPORT DATE: 07/22/88

OPERATING MODE: 1 POWER LEVEL: 098

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Robert E. Jenkins, Assistant Supervisor Technical Support
TELEPHONE #: 315-349-4220

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: SJ COMPONENT: HCU MANUFACTURER: P095
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: On June 22, 1988 at 0939 with the reactor mode switch in Run (Operational Condition 1) and at a power level of approximately 98% rated thermal capacity, Nine Mile Point Unit 2 (NMP2) experienced an automatic reactor scram and an isolation signal to the Group 4 and 5 Primary Containment Isolation Valves on a low (Level 3) reactor water level. The low reactor water level occurred as a result of a degraded feedwater flow condition caused by a feedwater level control valve (2FWS-LV10C) ramping closed. NMP2 operators subsequently restored feedwater flow to the reactor and brought level up to its normal range. The scram was reset and a normal shutdown was performed in accordance with the plant's shutdown procedure.

The cause for this event was determined to be a failure of a solenoid valve in the 2FWS-LV10C hydraulic control unit. However, the most probable root cause for this event is a manufacturing deficiency.

The corrective actions for this event are: (1) The solenoid valve for each feedwater level control valve hydraulic operator has been replaced; (2) Additional monitoring instrumentation has been installed on the 2FWS-LV10C control valve; (3) A Problem Report (PR) has been initiated and

the component vendor has been contacted concerning the identified manufacturing deficiencies; (4) An enhanced preventative maintenance program is being developed; and (5) A PR has been initiated requesting a design evaluation.

(End of Abstract)

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I. DESCRIPTION OF EVENT

On June 22, 1988 at 0939 with the reactor mode switch in Run (Operational Condition 1) and at a power level of approximately 98% rated thermal capacity, Nine Mile Point Unit 2 (NMP2) experienced an automatic reactor scram and an isolation signal to the Group 4 and 5 Primary Containment Isolation Valves. (Note: The Group 4 and 5 valves are various Residual Heat Removal Isolation valves.) This event was the result of a low water level (Level 3) in the reactor vessel caused by degraded feedwater flow.

The sequence of events for this incident is as follows:

Prior to the event feedwater was being supplied to the reactor vessel via Feedwater Pumps (2FWS-P1A and P1B). Because of erratic valve behavior from Feedwater Level Control Valve (2FWS-LV10B), Feedwater Pump 2FWS-P1B was secured (while reactor power level was temporarily reduced) and pump 2FWS-P1C was placed into service with flow established through Feedwater Level Control Valve (2FWS-LV10C).

At approximately 0939:11, Feedwater Level Control Valve 2FWS-LV10C unexpectedly ramped closed. As a result of the loss of feedwater flow via 2FWS-LV10C reactor water level started to decrease.

At 0939:36, reactor water level decreased to the Level 3 trip setpoint causing a reactor scram and an isolation signal to Primary Containment Isolation Valve Groups 4 and 5. (Note: No valve movement occurred since these valves are normally closed during power operation.)

At 0939:44, the NMP2 licensed operators placed the reactor mode switch to shutdown.

At 0939:57, the Reactor Recirculation Pumps (2RCS*P1A and 2RCS*P1B) automatically downshifted to slow speed operation. (This was an anticipated automatic response.)

At 0941:26, the Main Turbine-Generator tripped upon activation of its anti-motoring protective devices (as expected).

Between 0939 and 0945 the NMP2 operators re-established feedwater flow and restored reactor vessel water level up to its normal range by taking manual control of 2FWS-LV10A and 2FWS-LV10C. Reactor water level was maintained with Feedwater Level Control Valve 2FWS-LV55A.

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At 0945:34, the reactor scram was reset and a normal shutdown was commenced by NMP2 operators in accordance with Operating Procedure N2-OP-101C.

The duration for this event, from the initial event transient (closure of 2FWS-LV10C) to the resetting of the reactor scram was approximately 6 minutes. The individual systems and components functioned as designed. There were no other inoperable systems (other than those discussed) which contributed to this event. No other plant system or component failure resulted from this event.

II. CAUSE OF EVENT

The cause for this event was a malfunction of level control valve 2FWS-LV10C. However, the most probable root cause for this event is attributed to be a manufacturing deficiency.

Instrument and Control (I&C) technicians troubleshooting the malfunctioning hydraulic operator for 2FWS-LV10C (subsequent to this event) discovered several deficiencies concerning the solenoid valve. In light of these deficiencies, this investigation has postulated two probable failure mechanisms for 2FWS-LV10C.

The first concerns a deficiency found with the solenoid spring assembly. Specifically, the spring assembly was not assembled correctly and the spring in this assembly had a sharp edge which contacted the inside wall of the piston tube. It is surmised that this configuration enabled the spring to score the inside wall surface of the piston tube. Damage to the interior surface of the piston tube may have enabled the piston to become stuck in the open position venting hydraulic pressure used to keep 2FWS-LV10C open. With this solenoid valve stuck open, feedwater flow through 2FWS-LV10C would have been able to force that valve to close. This is considered to be a probable failure mechanism for the 2FWS-LV10C hydraulic operator.

The solenoid valves for the other two level control valves were disassembled and were verified not to have a similar defect.

The second failure mechanism postulates that a foreign object became caught

in the internal moving parts of the 2FWS-LV10C solenoid unit. It is surmised, that this object may have caused the solenoid to stick in the open position venting hydraulic pressure used to keep 2FWS-LV10C open. As stated above, with the solenoid valve stuck open, feedwater flow would have been able to force 2FWS-LV10C to close.

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Subsequent to this event, the hydraulic fluid for 2FWS-LV10C (and for the other two level control valves) was analyzed and found to be contaminated with particulate matter. Additionally, it was discovered that the 2FWS-LV10C solenoid lacked filter screens shown on the hydraulic controller design drawing. (Note: Filter screens were installed in the solenoid valve for 2FWS-LV10A but were found to be absent from the solenoid valves for 2FWS-LV10B and 2FWS-LV10C.) Lack of filter screens for the solenoid valve could have allowed particulate contamination to enter the internal mechanism of the solenoid thus causing the second failure mechanism discussed above.

Furthermore, this investigation has revealed additional material problems (although their effect on valve operability is still indeterminate) with these solenoid valves. Specifically, the following has been identified: (1) the o-rings in the flow control subassembly were found to be in a deteriorated condition after a relatively short period in use; (2) o-rings were found missing from the solenoid unit removed from 2FWS-LV10B; and (3) a solenoid disk installed in 2FWS-LV10A appears to be fabricated from a different material than similar disks installed in that solenoid and the solenoids for the other two level control valves. (These additional findings support the conclusion that a manufacturing deficiency is the most probable root cause for this event.)

III. ANALYSIS OF EVENT

This event is considered reportable via 10CFR50.73(a)(2)(iv) because the reactor scram and the primary containment isolation signals to the Group 4 and 5 isolation valves were automatic Engineered Safety Features (ESF) actuations.

A reactor scram occurred on a Level 3 reactor low level trip as a direct result of the degraded feedwater flow. A reactor scram is a conservative plant response which does not pose any safety consequences. The spectrum of events (which include the Group 4 and 5 isolation valves isolation signal) that occurred as a result of the degraded feedwater flow are bounded within the analysis of the "Loss of Feedwater Flow" event discussed in the Final Safety Analysis Report (FSAR) Section 15.2.7.

The elapsed time for the event, from the initial event transient to the resetting of the reactor scram was approximately 6 minutes.

IV. CORRECTIVE ACTIONS

As stated above, the immediate corrective actions that NMP2 operators took (subsequent to the reactor scram) were to restore feedwater flow to the reactor vessel and to get reactor water level back into its normal operating range. The plant was then normally shutdown via the scram recovery procedure N2-OP-101C. Additionally, troubleshooting 2FWS-LV10C was commenced by I&C, and other personnel.

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Other corrective actions for this event are:

1. The solenoid valve located in the hydraulic operator for the failed Feedwater Level Control Valve 2FWS-LV10C was replaced with a new unit. Additionally, as a precautionary measure, the electrical control card for 2FWS-LV10C and the solenoid valves for the other two Feedwater Level Control Valves (2FWS-LV10A, B) were also replaced. This work was done under Work Requests (WR) #131047, #134858, and #134859.
2. To better observe valve operation, additional instrumentation has been temporarily installed on the 2FWS-LV10C control valve via WR #138287.
3. Subsequent to this event, the solenoid valves removed from 2FWS-LV10A, B, C were disassembled and inspected for any nonconformities. The results from this inspection are discussed in this report. As a result of this investigation, the following corrective actions were taken: (A) The component vendor has been contacted concerning the deficiencies found with the 2FWS-LV10A, B, C hydraulic operator solenoid valves. The solenoid units will be sent back to the vendor to be rebuilt. (B) A problem report (PR #08018) has been initiated discussing the various deficiencies identified with these solenoid valves.
4. An enhanced preventative maintenance program is being implemented for the feedwater level control valve hydraulic operators. This program will be fully implemented by August 31, 1988. As part of this program periodic surveillance of the valve operators' hydraulic fluid will be conducted in accordance with the station's chemistry procedures. The surveillance frequency will be controlled by a future I&C procedure. This action will ensure timely replacement of hydraulic fluid if specified contamination levels are exceeded.
5. A PR (#8027) has been initiated requesting an evaluation of the necessity

for inclusion of filter screens in the feedwater level control valves' solenoid units.

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V. ADDITIONAL INFORMATION

A. Failed Component Identification: Level Control Valve Hydraulic Operator for 2FWS-LV10C.

Subcomponent: 4-way, 3-position solenoid valve

Part Number: 33896

Subcomponent manufacturer: Keane Control

Component Manufacturer: Paul-Munroe Hydraulics Inc.

Vendor: General Electric

B. LER 87-31 and LER 88-19 also discuss feedwater transients caused by feedwater control valve failures. However, those events were caused by failure of the feedback linkage for the associated control valves; whereas, this event was caused by a failure of a solenoid valve in the 2FWS-LV10C hydraulic operator. Therefore, these events are not similar.

C. Identification of Components Referred to in this LER

IEEE 803 IEEE 805

Component EHS Funct System ID

Level Control Valve LCV SJ

Hydraulic Control Unit HCU SJ

Turbine-Generator TG TA,TB

Reactor Recirculation Pump P AD

Isolation Valve ISV BO

Feedwater System N/A SJ

Reactor Recirculation System N/A AD

Primary Containment N/A NH

Residual Heat Removal System N/A BO

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NIAGARA NMP 37811

MOHAWK

NINE MILE POINT - UNIT 2/P.O. BOX 63, LYCOMING, NY 13093

TELEPHONE (315)343-2110

July 22, 1988

United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

RE: Docket No. 50-410
LER 88-25

Gentlemen:

In accordance with 10 CFR 50.73, we hereby submit the following
Licensee Event Report:

LER 88-25 Is being submitted in accordance with 10 CFR 50.73
(a)(2)(iv), "Any event or condition that resulted in
manual or automatic actuation of any Engineered Safety
Feature (ESF), including the Reactor Protection System
(RPS)."

A 10CFR50.72(b)(2)(ii) report was made at 1025 hours on June 22, 1988.

This report was completed in the format designated in NUREG-1022,
Supplement 2, dated September 1985.

Very truly yours,
/s/ J.L. Willis
J. L. Willis
General Superintendent
Nuclear Generation
JLW/POB/mjd
Attachments
cc: Regional Administrator, Region 1
Sr. Resident Inspector, W.A. Cook

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